

Day & Sea – A Serious Game for Climate Action

[Demo](#)

Introduction

We developed **Day & Sea**, a climate action game designed to inspire individual and collective environmental change through engaging gameplay focused on sea-level rise. This game was developed as a part of the Citris grant 2023/2024 for the project titled “Stimulating Behavior Change to Enhance Climate Resilience Policy and Action through a Serious Game Approach.”. *Day & Sea* is a climate action game designed to inspire climate action. The game was conceptualized during a collaborative gameathon, where the focus was on bridging the gap between digital interaction and real-world climate action. Centered on fostering individual, community, and policy-driven environmental actions, the game combines gamified mechanics and augmented reality (AR) mini-games to inspire real-world climate solutions. The mini-games are conceptualized to include immersive activities that educate players about environmental challenges and encourage activism through hands-on engagement. For instance, players might participate in a cleanup activity where litter appears in their real-world environment via augmented reality, allowing them to “remove” it through interactive gameplay. Other scenarios could involve restoring the coastal ecosystems by planting virtual mangroves or fostering coral reefs, visually demonstrating the positive effects of these actions. Each mini-game is designed to provide immediate feedback, showing players how their efforts contribute to combating rising sea levels and climate change. These activities not only enhance gameplay but also reinforce the connection between in-game actions and real-world environmental impact, creating a powerful, educational, and motivating experience.

Game Mechanics and Features

- **Augmented Reality Mini-Games:** Players participate in immersive AR tasks such as:
 - Virtual litter cleanups, where waste appears in the real-world environment through the camera.
 - Mangrove planting, showcasing the positive effects of ecosystem restoration.
- **Community-Driven Missions:** Collaborative challenges, like advocacy campaigns and virtual disaster response simulations, emphasize the power of collective action.
- **Dynamic Feedback System:** The virtual world dynamically evolves based on player actions. Positive efforts, like reforestation, result in cleaner skies and greener landscapes, while inaction leads to environmental degradation, reinforcing the urgency of climate action.

Game Design

The *Day & Sea* game combines immersive mini-VR experiences, community-driven activities, and real-world event organization, such as beach clean-ups and climate-focused discussions. Its futuristic yet user-friendly interface inspires players to take tangible actions

by linking their in-game progress to a dynamic virtual environment. This environment evolves to reflect player efforts, showcasing improvements for positive actions and deterioration for inactivity, creating a powerful visual and emotional connection to real-world environmental impact. The design fosters ongoing engagement and motivates meaningful contributions to sustainability efforts beyond gameplay.

The game immerses players in a dystopian near-future world devastated by climate change. Players take on the role of a protagonist tasked with restoring balance to Earth's environment through a series of engaging missions. Each task reflects real-world eco-conscious activities such as waste management, water conservation, energy efficiency, reforestation, and advocacy for sustainable practices.

The design leverages dynamic feedback to show the immediate environmental impact of player actions within the game. For example, completing tasks like fixing water leaks or planting trees visibly transforms the virtual world with greener landscapes and cleaner skies, reinforcing the positive effects of sustainable practices. Conversely, inactivity leads to environmental degradation, emphasizing the urgency of climate action.

The game also incorporates collaborative missions, encouraging players to work together on larger challenges such as advocacy campaigns or disaster response. These activities highlight the power of collective action in addressing environmental crises.

Through a futuristic, intuitive interface and immersive narratives, the game educates players about the environmental impact of everyday activities. It motivates real-world action by linking gameplay achievements with tangible improvements in the virtual environment, fostering a deeper connection between player efforts and global sustainability goals.



Figure 1: Samples of the game interface

UI and Game Play

Homepage:

The homepage serves as the central hub for players, providing an overview of their progress and key game features. It includes:

- **Points Display:** Shows the player's current points earned through tasks.
- **Profile Settings:** Access to personal game settings and customization options.
- **Toolbox:** Displays all owned tools that can be used for various tasks.

- **Warning Board:** A visual representation of the current environmental status in the game. Clicking it leads to a **Dashboard** with detailed stats such as toxin levels, waste generation, and their environmental impact, alongside recommendations for improvement.
- **Message Prompt:** Provides real-time guidance, warnings, or encouragement based on the player's actions. A button below directs players to the task list.
- **Navigation Bar:**
 - **Shop:** Players can purchase tools required for completing tasks.
 - **Leaderboard:** Displays rankings, awards, and badges to motivate competitive progress.
 - **Community:** Connects players to organized events, a chat section for discussions, and options to create their own events.

Task Page:

The task page presents a sequential list of available tasks, unlocking new ones upon completion of previous activities. Each task card includes:

- **Task Description:** A brief overview of the objective.
 - **Map Button:** Shows the locations where the task needs to be performed.
 - **Play Button:** Launches the task.
- Tasks can be replayed to further improve the environment, allowing players to make incremental progress toward sustainability.

Play Screen:

The play screen delivers an immersive task experience using augmented reality:

- **Camera Integration:** Activates the player's phone camera for a mixed-reality interface.
- **Guided Graphics:** Direct players to virtual objects or locations for task completion.
- **Map Access:** A quick reference tool for navigation.
- **Capture Button:** Used to collect virtual items or perform designated actions upon reaching a location.

This screen combines physical engagement with virtual interactivity, providing an engaging and educational gameplay experience. While performing tasks, players receive live information about the environmental impact of their actions and why these activities are critical. This real-time knowledge fosters a deeper understanding and inspires players to adopt similar eco-conscious behaviors in real life.

Game Development

The game development process emphasizes user experience (UX) and visual design, incorporating storyboarding, user flows, and interactive features. AR-based mini-games are analyzed for their potential to enhance community engagement, drawing on best practices observed in popular AR games.

The game begins with a user registration process where players create an account by providing an email and password. Users can also upload a profile picture. Unity's UI system is utilized for designing the registration interface. UnityEngine.UI is used for form input fields. Firebase Authentication handles user registration. Profile pictures are uploaded to Firebase Storage.

AR-Based Climate Change Tasks

Players can perform tasks related to climate change, such as adding a tree to a real-world location using AR. Unity's AR Foundation is employed for AR functionality, leveraging real-world mapping and interaction capabilities.

- **Technical Details:**

- AR Foundation integrates ARCore and ARKit support.
- GPS coordinates link virtual objects to real-world locations.
- Player actions are saved in Firebase Realtime Database for global visibility.

Task Interaction

Other players can view completed tasks, leave comments, and provide likes. This interaction is vital for community engagement.

- **Technical Details:**

- Tasks are fetched from Firebase Realtime Database.
- Comments and likes are stored in Firestore for scalability.
- Unity's UI system displays task details and interaction options.

Database Integration

Firebase Realtime Database and Firestore serve as the backend, ensuring real-time updates and scalability.

- **Technical Details:**

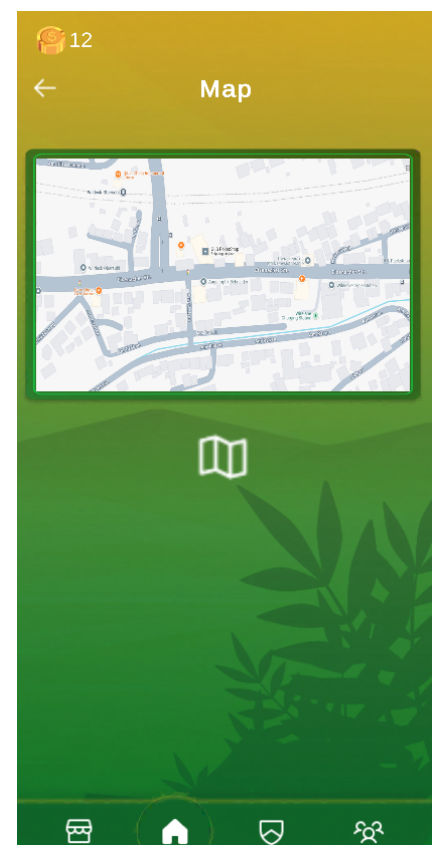
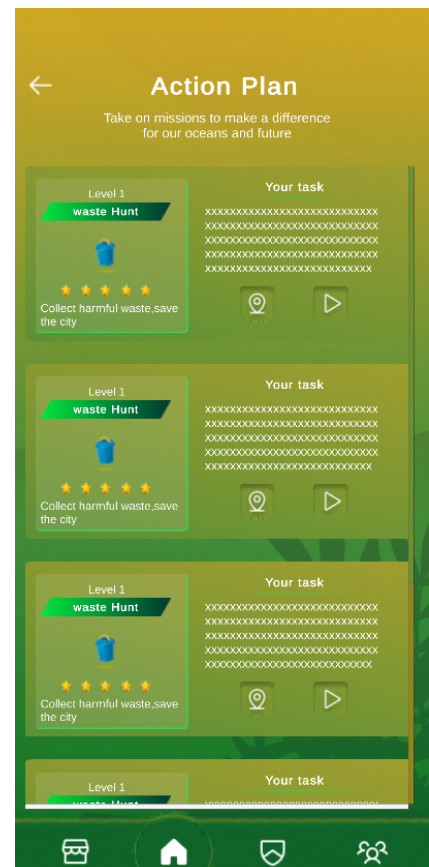
- Firebase Realtime Database is used for storing dynamic game data.
- Firestore is utilized for structured queries and advanced interactions.
- Firebase Authentication ensures secure access.

Map Integration for Location Access

Players can view their real-time location on a map within the game. This feature enables users to navigate to AR task locations and ensures accurate placement of AR objects. Unity's location services and third-party mapping tools are used for this functionality.

- **Technical Details:**

- UnityEngine.LocationService fetches the player's GPS coordinates.
- Map APIs, such as Google Maps SDK, render the real-time map.
- AR object placement is synced with the player's geographic position.



Acknowledgments

The game was developed as a team, including: Mennatullah Hendawy, Mohamed Samy, Anuraag Girdhar, Jiahong Li, Neelambika Manvi, Sanaz Khanali, Ulia Zaman, Victoria Lam, Magy Seif El Nasr. My role was to write the project proposal, coordinate the project, and facilitate the game then.